

# Journey to IPv6: A Real-World deployment for Mobiles



ITU/APNIC/MOIC IPv6  
Workshop  
19<sup>th</sup> – 21<sup>st</sup> June 2017  
Thimphu

# Acknowledgements

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- We would like to acknowledge Jeff Schmidt @ Telstra for permitting us to use his original APRICOT 2017 tutorial slides
  - <https://2017.apricot.net/program/schedule/#/day/9/journey-to-ipv6---a-real-world-deployment-for-mobiles>

# Agenda

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- Why IPv6?
- Business and Technical considerations
- Network Architectures
- Addressing and Subnetting
- Deployment Model
- Our Experience
- Q&A

# Why IPv6?

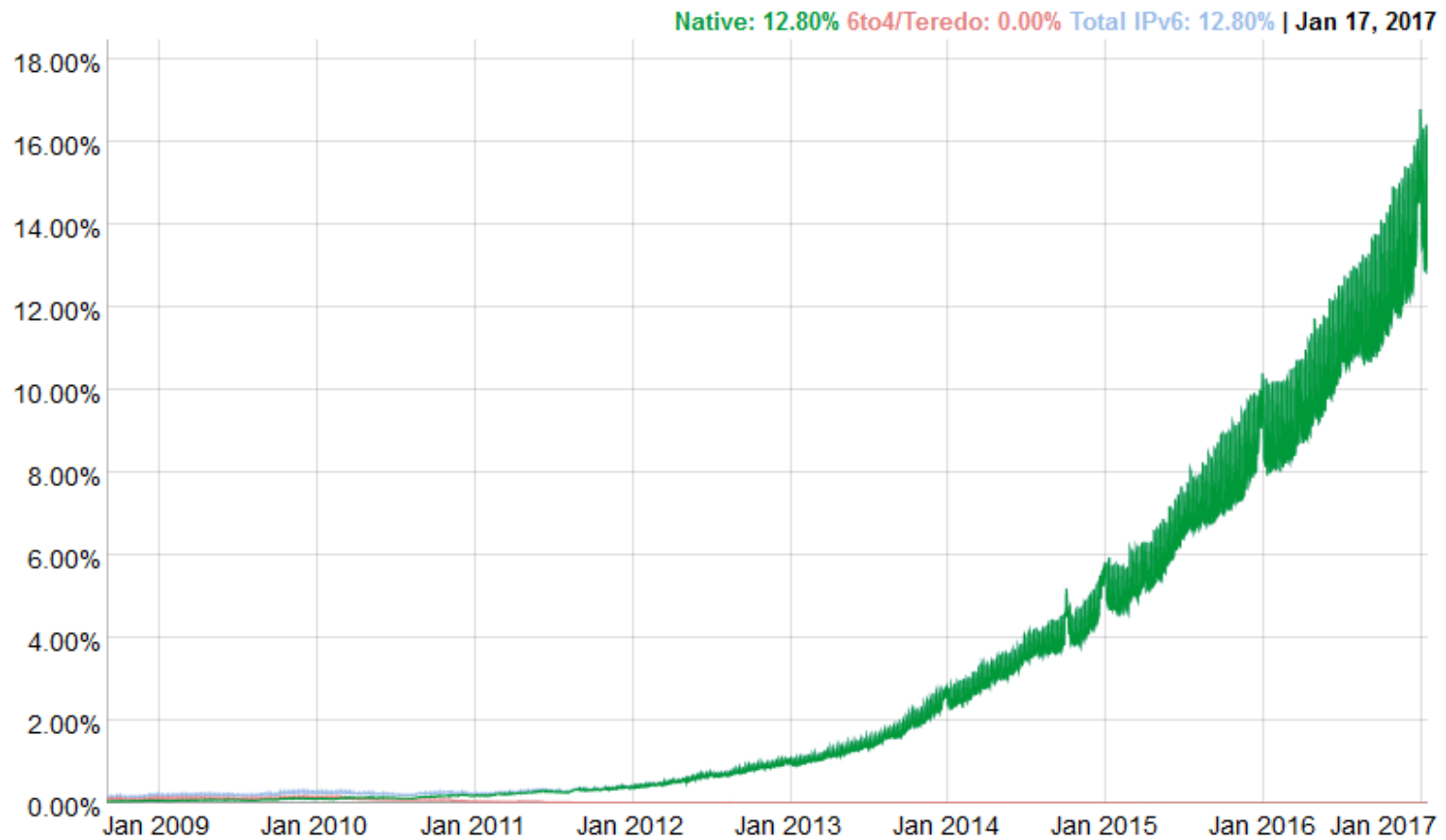


# Why IPv6?

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- Traffic growth and device per person
- Network readiness for new technologies:
  - Internet-of-Things
  - VoLTE/IMS
  - ViLTE
  - Management and Backhaul
- IPv4 public/private address depletion
- Reduction in network inefficiencies

# IPv6 Global Traffic



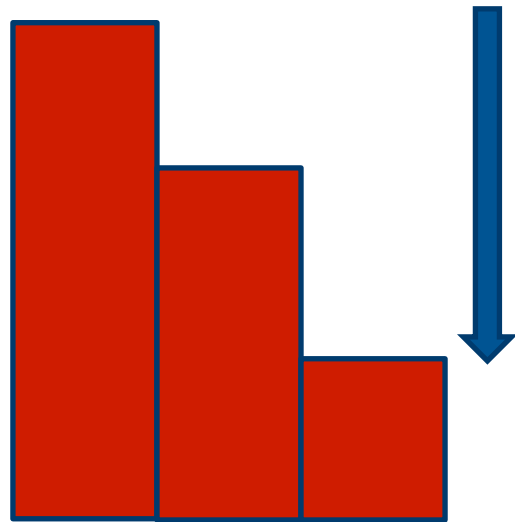
Source - <https://www.google.com/intl/en/ipv6/statistics.html>

# Business and Technical Considerations



# Business and Technical Considerations

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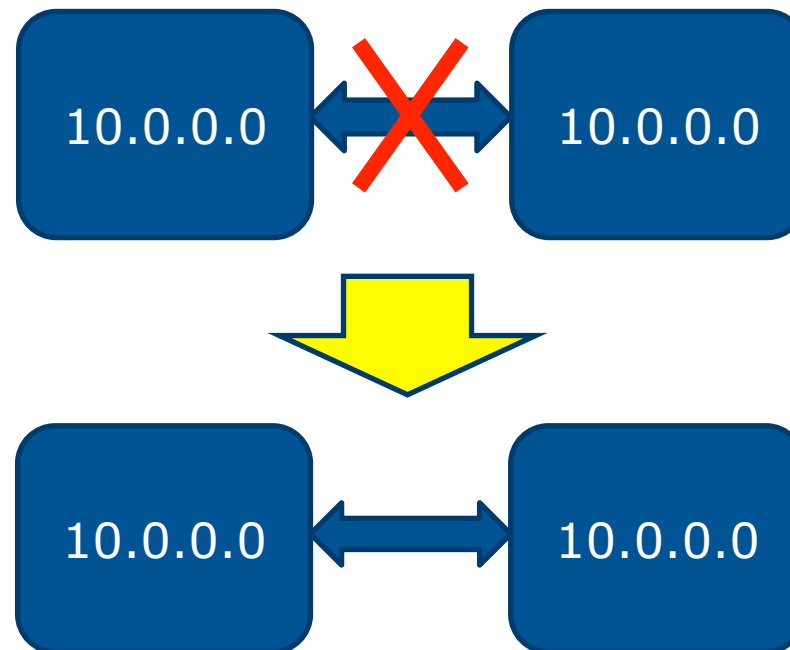
Depleting public and private IPv4 address range



# Business and Technical Considerations

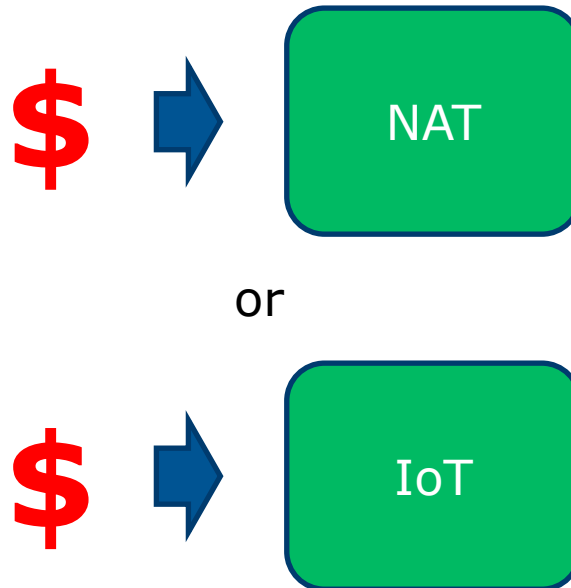
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- Non-interworking private IPv4 address ranges duplicated between domains, that now require interworking



# Business and Technical Considerations

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Continual investment to extend IPv4 resources vs IPv6 to future proof our network

# Business and Technical Considerations

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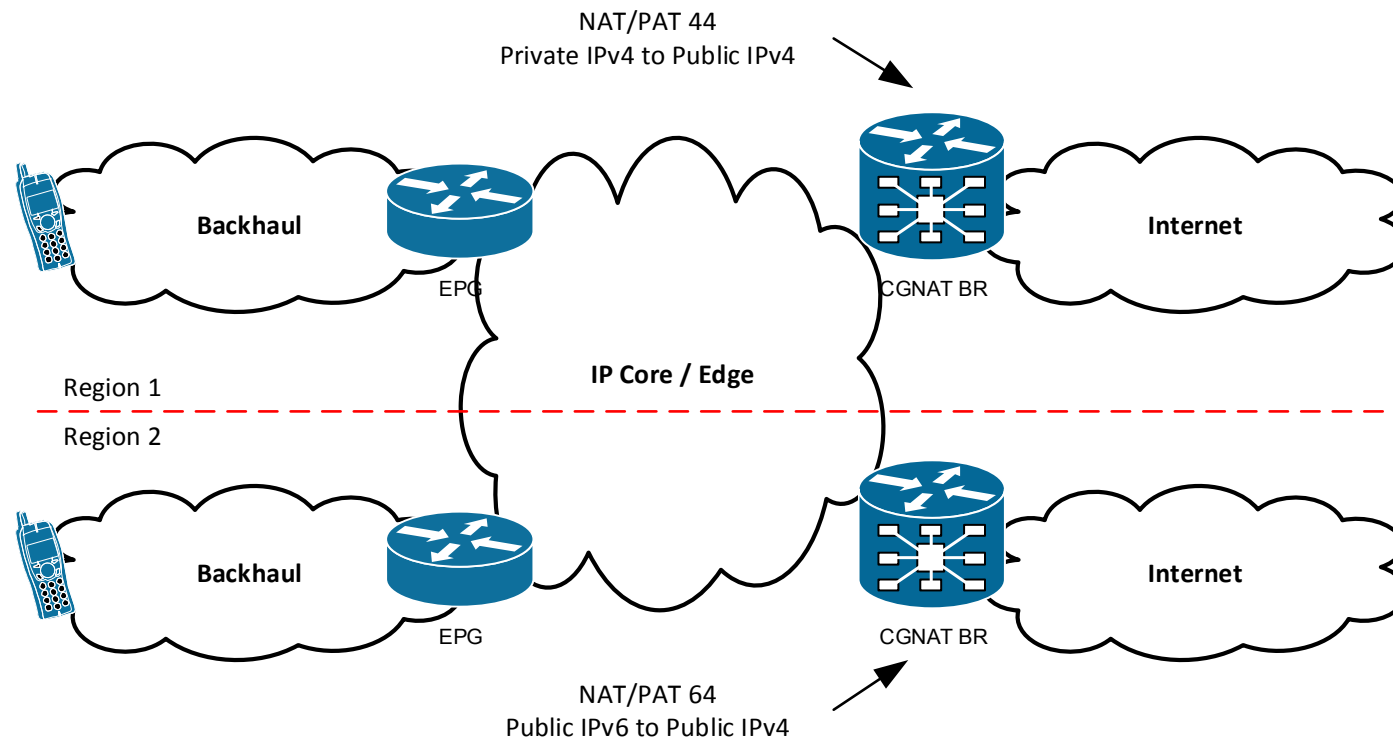
- As IPv4 addresses deplete, it will be more expensive to extend IPv4 resources
- Dual-Stack is an effective transition technology but does not solve the IPv4 depletion problem
- Introducing IPv6:
  - Reduced dependency on NAT
  - Remove the need for regionalisation
  - Pushes applications to move to IPv6

# Network Architectures



# IPv6 Implementation

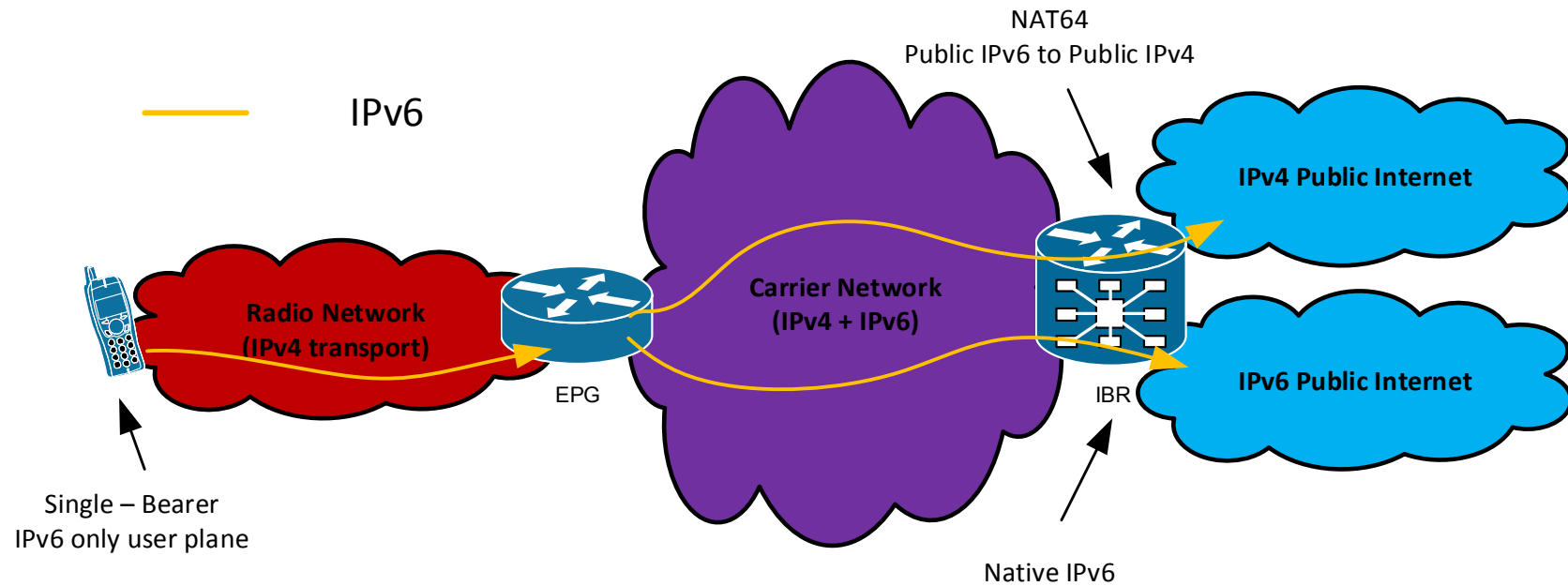
## Centralised CGN



- CGN performs NAT/PAT 44 and NAT/PAT 64
  - PAT substantially reduces Public and Private IPv4 address demand, but does not prevent IPv4 address depletion.

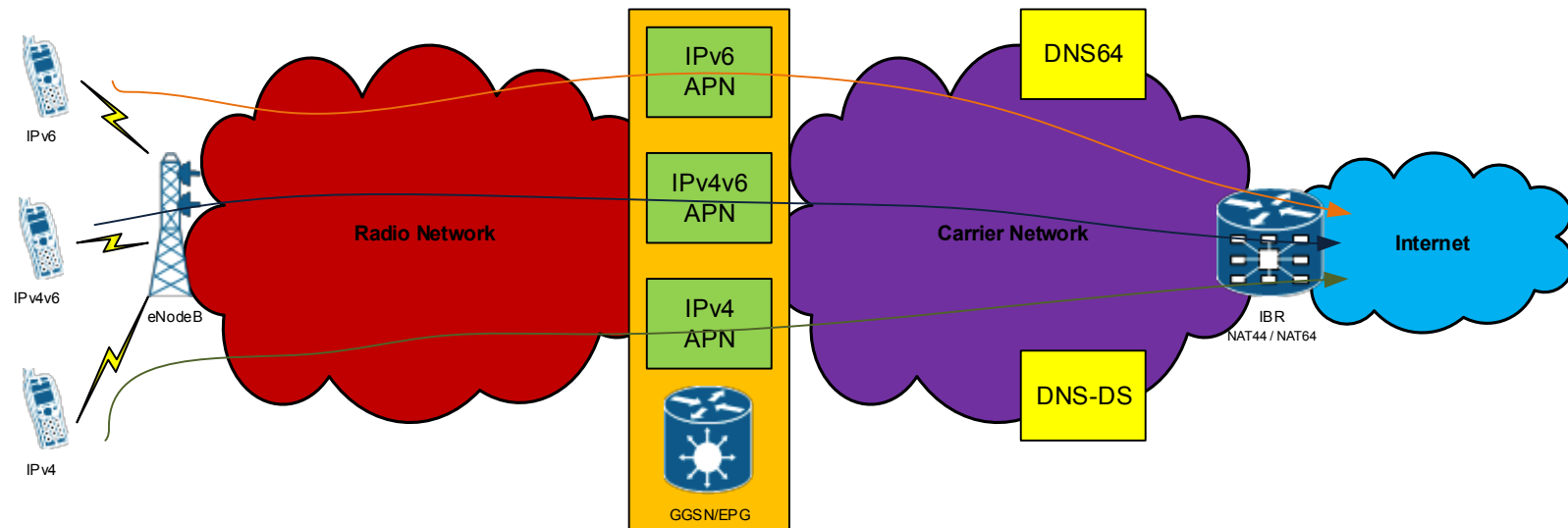
# IPv6 Implementation

## Traffic Flow



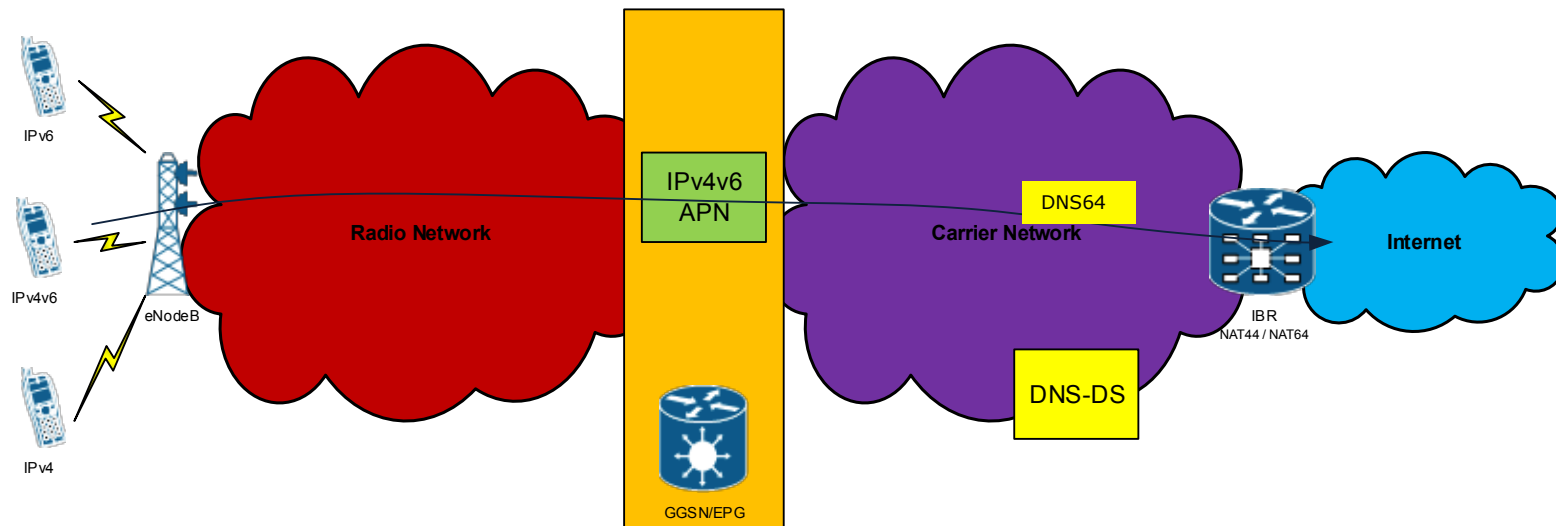
# Running multiple APNs

- Create multiple real APNs that supports IPv4, IPv6, and IPv4v6 individually



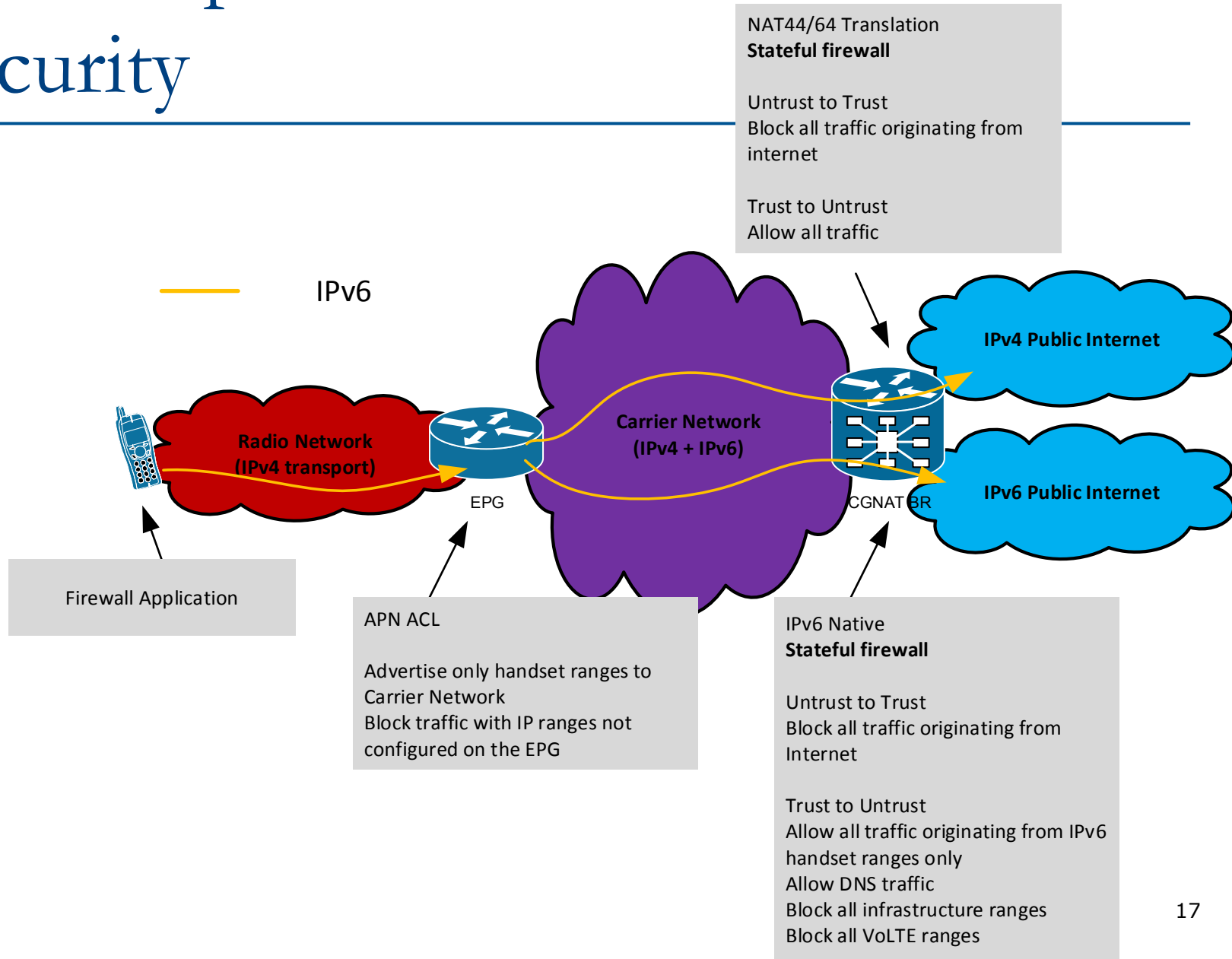
# Running a Single APN

- Create a single real APN that supports both DS and SS



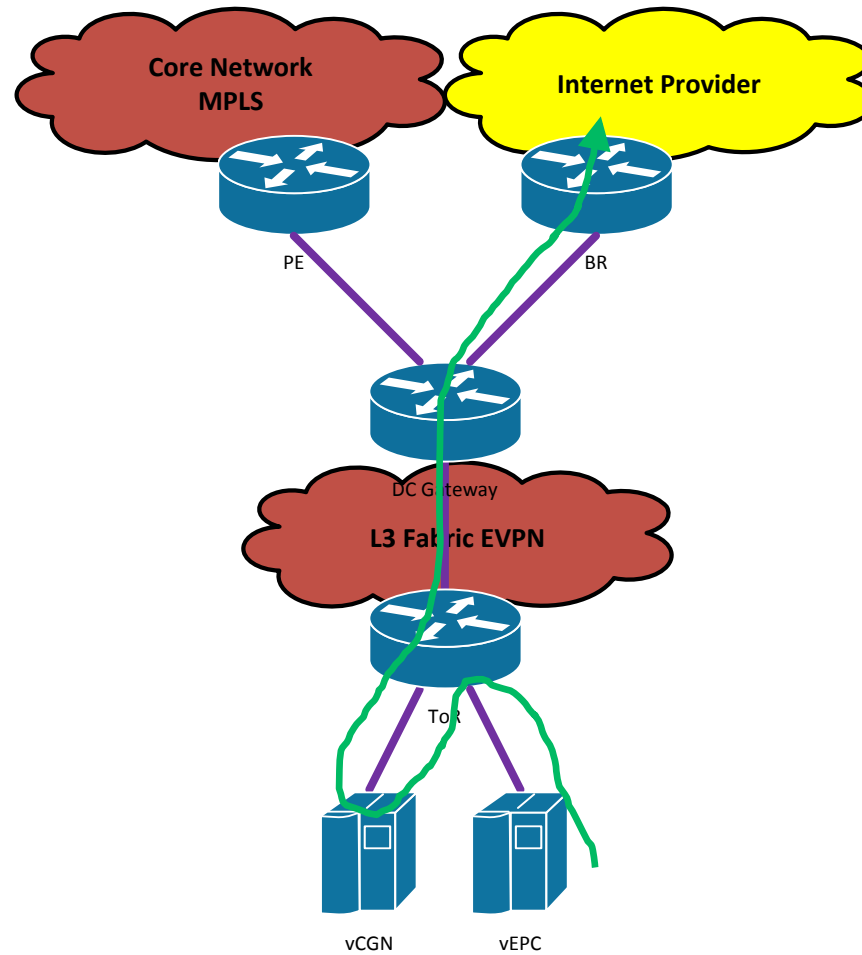


# IPv6 Implementation Security

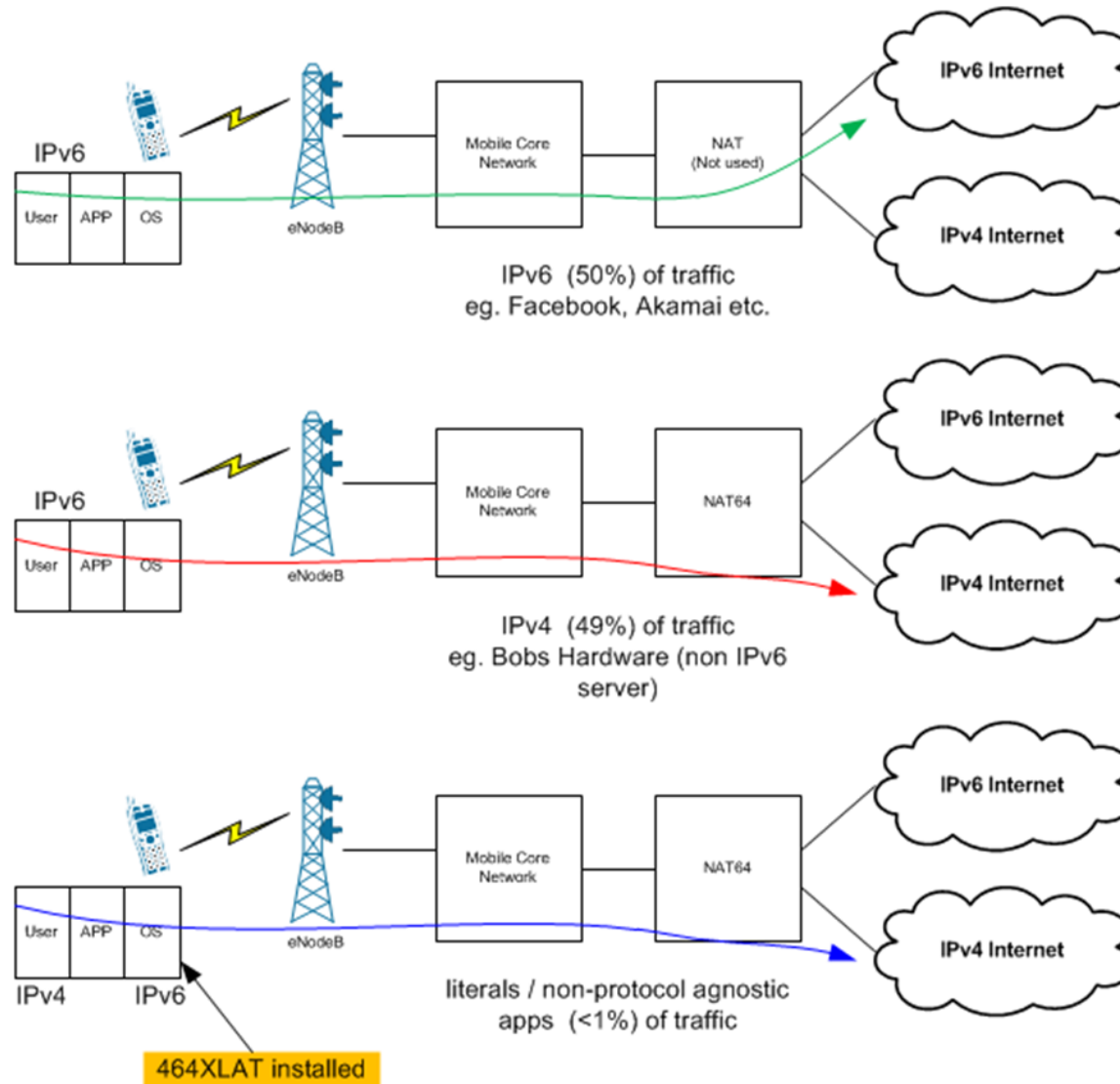


# Infrastructure Cloud IPv6

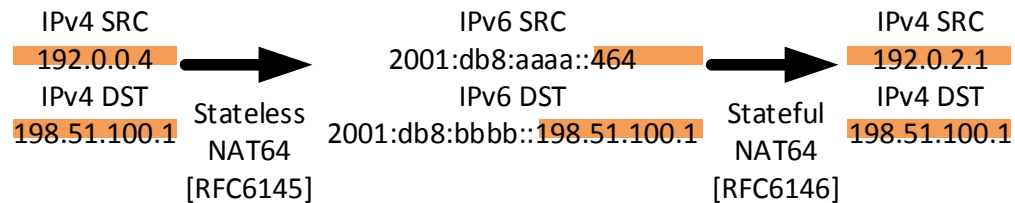
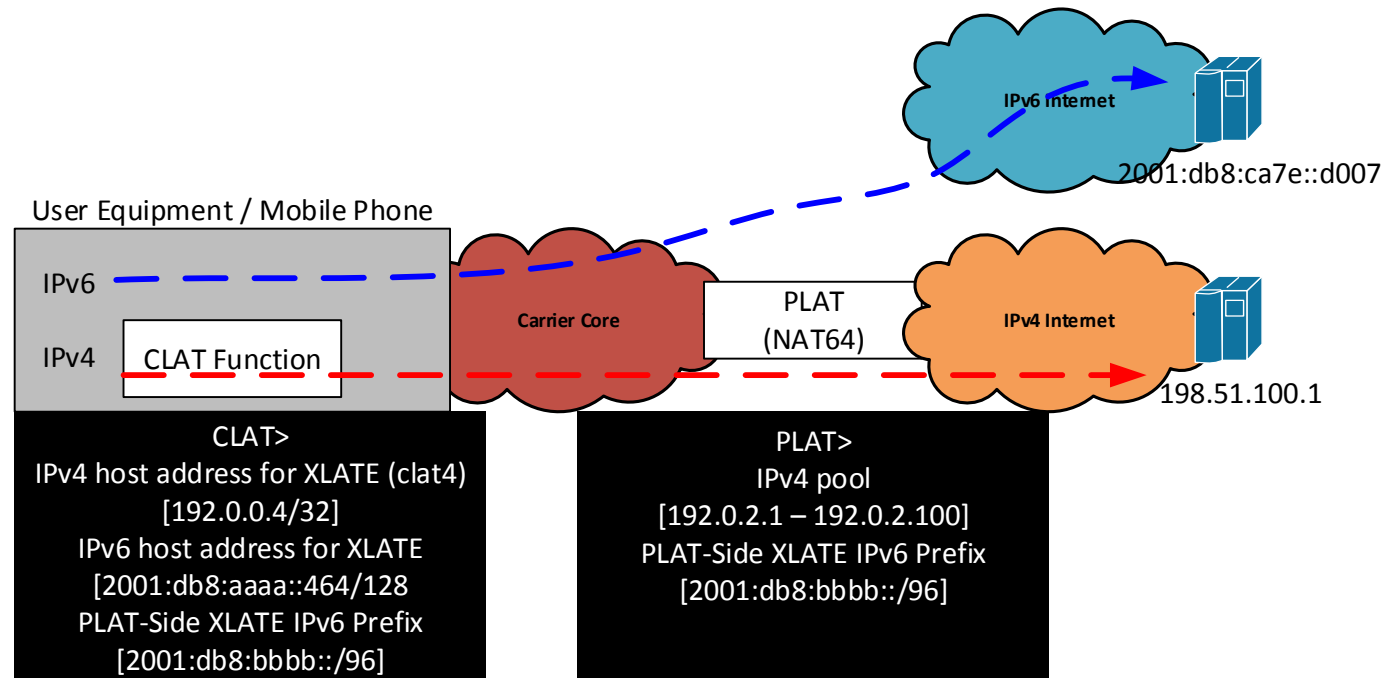
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# How much traffic will use IPv6?



# 464XLAT Architecture for Mobiles



# Addressing and Subnetting



# Addressing and Subnetting

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- ❑ 3GPP currently dictates each UE to receive a /64
- ❑ Future releases may require a /60 with DHCP-PD for single APN tethering
- ❑ 4x /44 per APN per EPG = 4M prefixes
- ❑ You will probably also need a similar range for VoLTE APNs
- ❑ KEY: make sure it is a structured subnetting schema so it is consistent nationally and across the entire organisation.

# Addressing and Subnetting

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- Infrastructure Addressing:
  - /64 per VLAN – Keep it simple!
  - Private or Public – but remember to use a firewall and policies to avoid advertising the infrastructure out to the internet!
  - NAT is not a security feature!

# Deployment Model





# Carrier Examples

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SP1

Dual-Stack

SP2 / SP3

SS+NAT64+DNS64+CLAT

SP4

SS/DS+NAT64+DNS-HD+CLAT

- ❑ Every carrier will have a unique set of circumstances that dictates which transition method they will use. There is no standard way of doing this.
- ❑ You must determine which is the best method for your network.
- ❑ **In any method, remember to ensure you have a long-term strategy for the eventual deployment of native Single Stack IPv6!**

# Different APNs for different purposes

Two existing APNs – one for Handsets, one for Mobile Broadband and Tethering



464XLAT + NAT64 + DNS64 for the Handset APN only

IPv6 enabled DNS for all other APNs

# Packet Core Configuration

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- HSS Configuration
  - PDP Context id = IPv4v6
- MME Configuration
  - DAF = set
- EPG Configuration
  - PDPTYPE = IPv4v6
  
- EPG will then also have the following as a minimum within each APN:
  - IPv6 Handset Range
  - IPv4 Handset Range
  - 2x IPv4 DNS Name Servers, 2x IPv6 DNS Name Servers

# UE Requirements and Settings

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- ❑ Android 4.3+ supports 4G/LTE. We recommend using anything that is 4.4.4+ or 5.1+
- ❑ Depending on your setup, either PDP selection is based on the UE or the Network.
- ❑ International Roaming over IPv6 works today! But we recommend the APN Roaming Protocol to be set to IPv4 only for the next two years.

# Launch Considerations

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- ❑ Informed Front of House and provided training, as well as Enterprise support and sales personnel
- ❑ Updated internal Knowledge Base
- ❑ Briefed Operations and provided training
- ❑ Created moderated forum with official details on the network change
- ❑ Provided direct email contact to Telstra Engineering
- ❑ Contacted the technical community via mailing lists and public forums before launch

# Our Experience

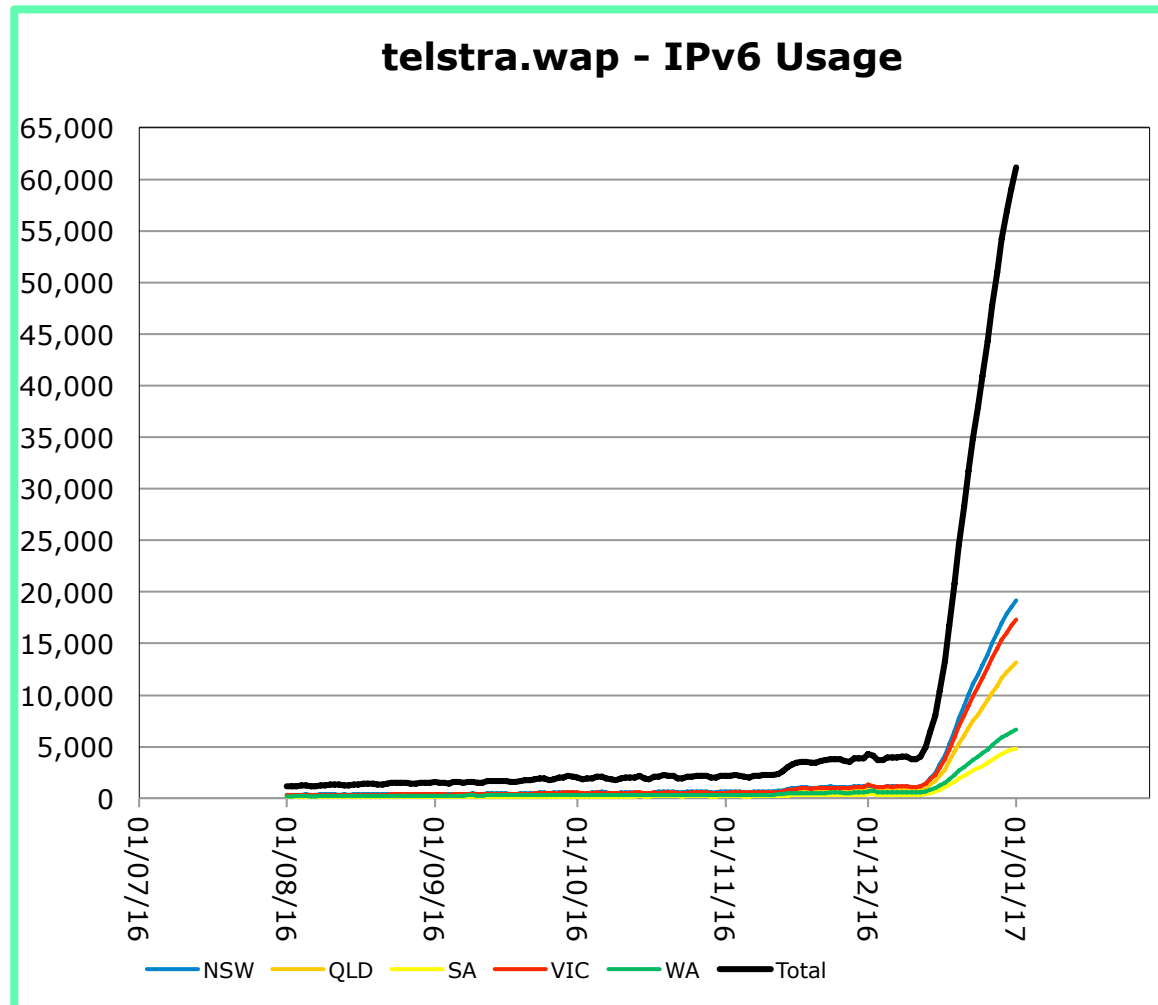


# Our Experience

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- iPad Dual-Stack Carrier Settings
  - Significant IPv6 takeup on iPads since carrier update was made available with Dual-Stack.
  - Update made via iOS patch. Users are not immediately aware IPv6 is available on their iPads. **Transparent migration.**
  - IPv6 take up occurs when iPads are patched to the latest version
  - Single Stack will come later this year

# Our Experience





# BYO device and existing services

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- ❑ **APN – IPv4v6, HLR/HSS – IPv4v6**
- ❑ Legacy devices configured with IPv4 only are not impacted
- ❑ New devices configured with IPv4v6 obtains both addresses and is currently growing significantly
- ❑ Existing devices configured with IPv6 only obtains IPv6 only
  
- ❑ **CGNAT**
- ❑ NAT64 ALGs: ftp, sip, pptp, rtsp, h323

# IPv4 vs IPv6

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- ❑ Some applications fail with IPv6 – even with 464XLAT. Routing issues?
- ❑ VPNs are a real problem – but is it a carrier problem or an application / server problem?
- ❑ HTTP / HTTPS works very well
- ❑ SSH is not a major problem
- ❑ IPv6 is faster in some cases – smaller BGP table, no NAT etc.
- ❑ Major apps work very well – especially from the major content providers

# Customer Support

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- ❑ Engage the community early so they know what's coming. They will appreciate you are still developing and they will want to be part of the journey!
- ❑ We receive support email through our contact points and reply as soon as possible. Don't keep your customers waiting
- ❑ Skip the red tape – let customers engage engineering directly
- ❑ Keep management happy! Report SIO and bandwidth usage!

# Q&A



# CONTACT



# Contact

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## □ Jeff Schmidt

- Technology Team Manager  
Telstra Wireless Network Engineering
- [sunny.yeung@team.telstra.com](mailto:sunny.yeung@team.telstra.com)

## □ Sunny Yeung

- Senior Technology Specialist  
Telstra Wireless Network Engineering
- [sunny.yeung@team.telstra.com](mailto:sunny.yeung@team.telstra.com)